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(54) Kerb-climbing device for a wheeled vehicle.

(57) A wheelchair has two detachable, swingable attachments each comprising a footrest 8 and an obstruction-climbing device 9. Each device 9 comprises a sectorial strut 18 including an arcuate obstruction-contacting part 19 and arranged to turn about a horizontal pivot relative to the footrest 8. Acting between the strut 9 and the footrest 8 is a piston-and-cylinder damping device 15 of which the cylinder is oil-filled and contains a return spring. The damping device includes a piston rod of which the upper end zone 21 is of hook shape to hook over the pivot in an idle position (18') of the obstruction-climbing device 9.

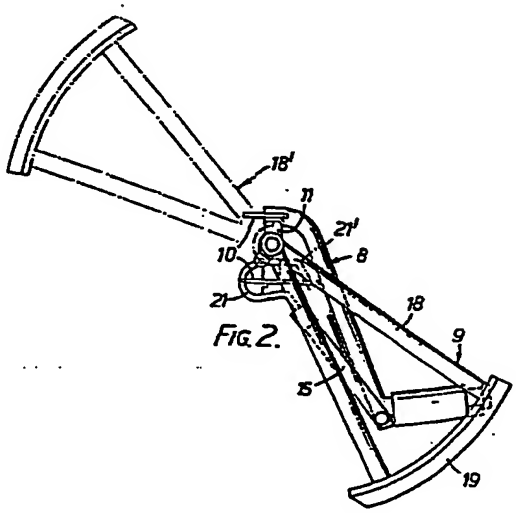

Fig. 2.

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This invention relates to a wheeled vehicle, an attachment therefor, and a piston-and-cylinder device which said attachment may comprise. The invention is particularly concerned with kerb-climbing devices of wheelchairs.

British Patent Specification 1569166 discloses a powered wheelchair with two large-diameter rear driven wheels and two small-diameter front castor wheels. Mounted on the wheelchair frame at respective locations above the castor wheels are two footrests turnable about respective vertical axes, and also two kerb-climbing devices including respective struts turnable about a horizontal axis. Each kerb-climbing device is fixed to the frame by fixing means including a bolt and a wing nut. Each strut includes an arcuate rocker end which contacts the kerb to be climbed. Acting between the wheelchair frame and the strut is a return sping.

Each strut is turnable rearwards from a ready position in which it extends downwards and forwards, against the action of the spring. In one version disclosed, when the spring returns the strut to its ready position, an arm of the kerb-climbing device strikes a locking plunger mounted on the wheelchair frame. Each plunger can be withdrawn manually by a knurled pin against the action of a spring, to allow the strut to be swung rearwards, against the action of its return spring, past the plunger, and then the plunger is released to detain the strut in an idle position in which it extends rearwards and upwards. Each arm is pivotally mounted at one end on its strut and at the other end is urged against a stop by a spring, so that, if an abnormal force urges the arm against its plunger, for example when the wheelchair is descending a kerb backwards, the spring yields whilst the arm remains in contact with its plunger, and no damage is done. In another version disclosed, each strut return spring is housed in a cylinder which is turnably mounted on the

wheelchair frame and through which extends a rod encircled by the spring and articulated to the strut. In the ready position of the strut, a circlip on the rod abuts against an annular disc supported by the strut return spring. To bring the strut into an idle position in which it extends upwards and rearwards it is swung forwards and over its pivot, to carry it through a dead-centre position of the cylinder and the rod into the idle position, in which the circlip again abuts against the annular disc. In a third version, each strut return spring is a prestressed helical torsion spring the ends of which, in the ready position, press on opposite edges of projections fixed to walls of an assembly. To bring the strut to an idle position, a reciprocable pin is manually disengaged to release the assembly for turning relative to the wheelchair frame, and after turning of the strut and the assembly, the assembly is then re-connected to the frame by engagement of the pin.

Such kerb-climbing devices have various disadvantages. Firstly, the striking of the strut abutments against the frame abutments on return to the ready positions produces jolts and noise which can be distressing and embarrassing for the patient in the wheelchair. Secondly, compared to the conventional, simple arrangements permitting easy detachment of footrests or legrests from wheelchair frames, the bolt-and wing-nut-arrangements make detachment of the kerb-climbing devices from the frame difficult, particularly for the patient in the wheelchair. Thirdly, in moving the strut from its ready position to its idle position, either some detent, i.e. the plunger or the pin, has to be disengaged beforehand, which can be awkward particularly for the patient in the wheelchair, or circlips and discs come to abut each other, thereby creating jolts and noise.

United States Patent Specification 2,612,379

discloses attachments which can be applied to a vehicle such as a hand truck and which enable the truck to be drawn smoothly over a flight of steps. The attachments each include a sectorial strut pivotally mounted on the frame of the truck and having an arcuate rocker end which contacts the edge of the step. Connected between the strut and the frame are a piston-and-cylinder device of which the piston is interposed between two helical springs for maintaining the strut in its ready position. This attachment has a number of disadvantages which make it unsuitable particularly for use on an invalid carriage. Firstly, the actual position of the strut in its ready condition is liable to vary considerably, since the springs allow the strut to swing to-and-fro, which is most likely to occur if the truck is being roughly handled over rough ground, with the result that the arcuate rocker end misses the step edge and the vehicle runs hard up against the step. Secondly, the attachments are not readily detachable from the vehicle.

There is known from Federal German Patent Specification 2922963 a double-acting shock-absorbing device for sliding doors and the like, comprised of a cylinder containing, near respective ends of the cylinder, two pistons with one or two compression springs between them. Through the pistons extend respective piston rods which not only project axially outwardly from the housing for connection to sliding door parts, but also project axially inwardly from the pistons and are there hollow for enabling a damping fluid contained in the cylinder to flow to the spaces between the pistons and their adjacent cylinder ends. Fixed co-axially in the hollow inner end of one of the piston rods is a piece of tube extending towards the other piston rod. As the pistons are moved towards each other from their outer end positions, this tube piece approaches the hollow inner end of the other piston rod and then begins to penetrate it. Since the latter

hollow inner end narrows conically axially outwardly, the free gap between the tube piece and the hollow inner end continuously decreases. This arrangement gives a progressively greater damping effect by the damping fluid. In the rest condition of this shock-absorbing device, the pistons lie against shoulders on the inside of the cylinder.

This shock-absorbing device is unsuitable for use in obstruction-climbing devices of vehicles, because the pistons lie against abutments in the rest condition and there is no significant damping effect in the rest condition.

According to a first aspect of the present invention, there is provided a wheeled vehicle, at least one wheel of which has associated therewith a device for facilitating negotiation by said wheel of a kerb or similar obstruction, said device comprising a strut mounted on the vehicle for turning about a horizontal axis higher than the axis of the wheel, and liquid damping means arranged to damp the turning movement of said strut about said horizontal axis in a ready position of said strut, the arrangement being such that, when the free end of the strut encounters said obstruction, it rocks on the obstruction, lifting the vehicle in the zone of said wheel and thereby enabling the wheel to pass onto the obstruction.

An advantage of this vehicle is that the strut can be reliably maintained in a relatively unvarying ready position, without the return of the strut to its ready position producing any substantial jolting or noise.

According to a second aspect of the present invention, there is provided a wheeled vehicle including a frame and an attachment detachably mounted on said frame, at least one wheel of said vehicle having associated therewith a device for facilitating negotiation by said wheel of a kerb or similar

obstruction, said attachment comprising said device and a rest for a foot or a leg of an occupant of the vehicle.

According to a third aspect of the present invention, there is provided an attachment for detachably mounting on a frame of a wheeled vehicle, said attachment comprising a device for association with a wheel of said vehicle for facilitating negotiation by said wheel of a kerb or similar obstruction, and a rest for a foot or a leg of an occupant of the vehicle.

Such combining together of an obstruction-climbing device and a foot-or leg-rest enables the combined attachment to be readily removable as a single unit from the vehicle.

According to a fourth aspect of the present invention, there is provided a wheeled vehicle, at least one wheel of which has associated therewith a device for facilitating negotiation by said wheel of a kerb or similar obstruction, said device comprising a strut mounted on the vehicle for turning about a horizontal axis higher than the axis of the wheel, a spring arranged to apply a moment to said strut to maintain said strut in a ready position, said strut being turnable about said axis from said ready position, in which said spring applies a moment to said strut in one sense round said axis, into an idle position, in which said spring applies a moment to said strut in the opposite sense and stop means detains said strut in said idle position, and an elongate member by way of which said spring acts on said strut, said elongate member being connected to a portion of said spring which remains in a substantially fixed position relative to said elongate member throughout movement of said strut between said ready position and said idle position, and the arrangement being such that, when the free end of the strut in said ready position encounters said obstruction, it rocks on the obstruction, lifting the

vehicle in the zone of said wheel and thereby enabling the wheel to pass onto the obstruction.

The arrangement whereby the aforesaid portion of the spring remains in a substantially fixed position relative to the elongate member has the advantage of avoiding moving into abutment, and thus of avoiding consequential jolting, noise and wear.

According to a fifth aspect of the present invention, there is provided a piston-and-cylinder device, including spring means arranged in the cylinder and acting between the piston and the cylinder, an abutment bearing one end of said spring means and arranged to move longitudinally with one of the piston and the cylinder relative to the other, said cylinder and said piston being turnable relative to each other about the axis of the cylinder to adjust said abutment along said one of the piston and the cylinder, thereby to adjust said one end of said spring means along said one of the piston and the cylinder.

This device has the advantage that the rest position of the piston relative to the cylinder can be readily adjusted.

In order that the invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 shows a side view of an occupied, motorized wheelchair climbing a kerb-like obstruction,

Figure 2 shows a side elevation of an attachment of the wheelchair, the attachment including an obstruction-climbing device which is shown in full lines in a ready position and in dot-dash lines in an idle position,

Figure 3 shows a front elevation of the attachment, with the obstruction-climbing device in its ready position, and

Figure 4 shows an axial sectional view through a

piston-and-cylinder device of the obstruction-climbing device.

Referring to the drawings, the wheelchair 1 has two large-diameter rear wheels (of which one is seen and referenced 2) reversibly driven by respective electric motors (of which one is seen and referenced 3). The wheelchair 1 also includes two small-diameter, castor, front wheels 4, the wheels 2 and 4 being mounted on a transversely collapsible frame of the wheelchair. At its front, the frame of the wheelchair includes two uprights (of which one is seen and referenced 6), on which respective attachments 7 are so mounted as to be swingable about the uprights from the forwardly projecting positions shown in Figure 1 outwardly into positions in which they are detachable from the uprights.

Each attachment 7 comprises a footrest 8 and an obstruction-climbing device 9 mounted on the footrest 8. Thereby the footrest 8 and the device 9 can be removed as a unit from the wheelchair frame to facilitate replacement temporarily by a conventional footrest unit where necessary to reduce the wheelchair width for passing through doorways, for example, or where kerb-climbing ability is not required. In a conventional manner, the footrest 8 includes two horizontal plates 10 by way of which it is mounted on two vertical pivot pins fixed to the upright 6. The plates 10 are fixed to a tubular bracket 11, a forwardly projecting part 12 of which pivotally supports a foot pad 13. Fixed to and projecting laterally outwards from the part 12 is a horizontal pivot pin 14 on which is pivotally mounted the lower end of a cylinder 15 of a piston-and-cylinder device 15, 16 of the device 9. Fixed to the upper part of the bracket 11 is a horizontal axle 17 on which a sectorial strut 18 is pivotally mounted. The strut 18 includes an arcuate obstruction-contacting part 19. The piston 16 includes a piston rod 20 the upper end zone 21 of which is in the shape of a hook and terminates on the

axis A of the device 15, 16. At this terminal end it is horizontally articulated to a horizontal bush 32 of the strut 18 by way of a horizontal nut-and-bolt device 33. The cylinder 15 is oil-filled and sealed in a liquid-tight manner at each end. At its upper end, it is sealed by a stopper 22 which sealingly encircles the piston rod 20. The stopper 22 includes a bush 23 formed with an axially downwardly facing frusto-conical bearing surface 24 which bears an upper end of a helical compression spring 25 encircling the piston rod 20. The lower end zone of the piston rod 20 is formed with external screwthreading 26 on which is screwed an internally threaded bush 27 formed with an axially upwardly facing frusto-conical bearing surface 28 which bears the lower end of the spring 25. Two nuts 29 are screwed onto the lower end of the piston rod 20 and clamp a washer 30 between them. Between the washer 30 and the inner cylindrical wall of the cylinder 15 is a clearance through which the oil in the cylinder can be forced to flow.

The method of use of the obstruction-climbing device 9 is as follows:-

The strut 18 normally occupies its ready position shown in Figure 2, in which it is maintained by the clockwise moment produced by its own weight being opposed by the anti-clockwise moment produced by the spring 25. The damping provided by the oil in the cylinder 15 substantially prevents any undesired oscillatory movement of the ready strut 18 during travel of the wheelchair. During such travel, the castor wheels 4 themselves cope with any small obstructions on the ground or floor, such as those which are about 1" or 2" high. However, any obstructions above that general height and up to about 5" high are encountered by and negotiated with the aid of the device 9. As the wheelchair advances towards the obstruction 31, the obstruction-contacting parts 19 come to bear against the

obstruction. The continued operation of the motors of the wheelchair and thus the continued driving of its rear wheels causes each strut 18 to rock upon the obstruction while the wheelchair advances against the action of the spring 25 and against the damping action of the oil in the cylinder 15, so lifting the front of the wheelchair (through for example the condition shown in Figure 1), until the wheels 4 ride up onto the obstruction 31. Thereupon, each strut 18 is swung back into its ready position shown in Figure 2 by the spring 25, but against the damping action of the oil in the cylinder 15. The rear wheels are of course of a sufficient diameter to be able to ride up onto the obstruction 31 simply under the action of the motors. In order that the strut 18 can be put into an idle position in which it is out of the way of the footrest 8, to facilitate manoeuvering in level, but cramped, conditions, it can be swung clockwise from the ready position shown in Figure 2 into an idle position 18' indicated in dot-dash lines in Figure 2. In this condition of the device 9, the hook-shaped zone 21 is hooked over and bears against the bush 32, as indicated at 21', in which condition the axis A has been displaced in a vertical plane and through the horizontal axis of the axle 17, so that the spring 25 is applying to the strut 18 a clockwise moment, which moment is significantly greater than the anti-clockwise moment produced by the weight of the strut in its position 18'. The strut 18 is thereby maintained in that position until it is desired to return it anti-clockwise to its ready position, which the occupant can initiate by simply pressing the strut 18 downwards through the dead-centre position. That end of the spring 25 adjacent the bush 27 remains in contact therewith throughout movement of the piston rod 20 relative to the cylinder 15.

The connection of the upper end of the piston rod

20 to the bush 32 by way of the nut-and-bolt device 33 allows the piston rod 20 to be disconnected from the bush 32 and rotated about the axis A. Such rotation is required to adjust the compression in the spring 25 for a given length of the device 15, 16, so as to permit angular setting of the ready position of the strut 18. Rotation of the piston rod 20 achieves such adjustment because it screws the bush 27 along the piston rod 20, the bush 27 being held against rotation with the piston rod 20 by the frictional forces between the ends of the spring 25 and the frusto-conical bearing surfaces 24 and 28 of the bushes 23 and 27.

CLAIMS:

1. A wheeled vehicle, at least one wheel (4) of which has associated therewith a device (9) for facilitating negotiation by said wheel (4) of a kerb or similar obstruction (31), said device (9) comprising a strut (18) mounted on the vehicle (1) for turning about a horizontal axis higher than the axis of the wheel (4), and damping means (15, 16) arranged to damp the turning movement of said strut (18) about said horizontal axis, the arrangement being such that, when the free end (19) of the strut (18) encounters said obstruction (31), it rocks on the obstruction (31), lifting the vehicle (1) in the zone of said wheel (4) and thereby enabling the wheel (4) to pass onto the obstruction (31), characterised in that said damping means (15, 16) is liquid damping means (15, 16) arranged to damp said turning movement in a ready position of said strut (18).

2. A vehicle according to claim 1, wherein said liquid damping means (15, 16) comprises a cylinder (15) containing the damping liquid, a piston head (29, 30) in said cylinder, a piston rod (20) connected to said piston head (29, 30), aperture means whereby said liquid can flow from one axial side of said piston head (29, 30) to the other in a throttled manner, and a return spring (25) arranged to return said strut (18) to said ready position after said strut (18) has rocked on said obstruction (31).

3. A vehicle according to claim 2, wherein said return spring (25) extends between said piston head (29, 30) and one end of said cylinder (15) and encircles said piston rod (20), which is connected to an end portion of said spring (25) which remains in a substantially fixed position relative to said rod (20) throughout movement of said strut (18).

4. A vehicle according to claim 2, wherein said return spring (25) extends between said piston head (29, 30) and one end of said cylinder (15) and encircles said

piston rod (20), and there is on said piston rod (20) an abutment (27) bearing one end of said spring (25) and arranged to move longitudinally with the piston (16), said piston (16) and said cylinder (15) being turnable relative to each other about the axis of the cylinder (15) to adjust said abutment (27) along said piston rod (20), thereby to adjust said one end of said spring (25) along said piston rod (20).

5. A vehicle according to claim 4, wherein said abutment (27) has means (28) serving to discourage rotation of said abutment (27) relative to said piston rod (20) about said piston rod (20), and wherein the other end of said spring (25) bears on said cylinder (15) by way of means (24) serving to discourage rotation of said spring (25) relative to said cylinder (15).

6. A vehicle according to claim 5, wherein each said means (24, 28) serving to discourage rotation comprises a frusto-conical bearing surface (24, 28) facing said spring (25) and substantially co-axial with said piston rod (20).

7. A vehicle according to any preceding claim wherein said strut (18) is turnable from said ready position, in which said spring (25) applies a moment to said strut (18) in one sense round said axis, into an idle position (18'), in which said spring (25) applies a moment to said strut (18) in the opposite sense and stop means (21, 32) detains said strut (18) in said idle position (18').

8. A vehicle according to claim 7, wherein said cylinder (15) is mounted for turning about a transverse horizontal axis remote from the outer end (21) of said piston rod (20), and said stop means (21, 32) comprises a stop (32) arranged on the axis of turning of said strut (18), and a hook-form part (21) of said piston rod (20) outside said cylinder (15) and arranged to hook about and bear against said stop (32) in said idle position (18') of said strut (18).

9. A vehicle according to claim 8, wherein said stop (32) is fixed to said strut (18) and pivotally mounts the outer end (21) of said piston rod (20).

10. A vehicle according to any preceding claim, and including a frame (6) and an attachment (7) detachably mounted on said frame (6), said attachment (7) comprising said device (9) and a rest (8) for a foot or a leg of an occupant of the vehicle (1).

11. A wheeled vehicle including a frame (6) and an attachment (7) detachably mounted on said frame (6) and comprising a rest (8) for a foot or leg of an occupant of the vehicle (1), at least one wheel (4) of said vehicle (1) having associated therewith a device (9) for facilitating negotiation by said wheel (4) of a kerb or similar obstruction (31), characterised in that said attachment (7) also comprises said device (9).

12. An attachment for detachably mounting on a frame of a wheeled vehicle, said attachment (7) comprising a rest (8) for a foot or a leg of an occupant of the vehicle (1), characterised in that said attachment (7) also comprises a device (9) for association with a wheel (4) of said vehicle (1) for facilitating negotiation by said wheel (4) of a kerb or similar obstruction (31).

13. A wheeled vehicle, at least one wheel (4) of which has associated therewith a device (9) for facilitating negotiation by said wheel (4) of a kerb or similar obstruction (31), said device (9) comprising a strut (18) mounted on the vehicle (1) for turning about a horizontal axis higher than the axis of the wheel (4), a spring (25) arranged to apply a moment to said strut (18) to maintain said strut (18) in a ready position, said strut (18) being turnable about said axis from said ready position, in which said spring (25) applies a moment to said strut (18) in one sense round said axis, into an idle position (18'), in which said spring (25) applies a moment to said strut (18) in the opposite sense and stop means (21, 32) detains said strut (18) in

said idle position (18'), and an elongate member (20) by way of which said spring (25) acts on said strut (18), and the arrangement being such that, when the free end of the strut (18) in said ready position encounters said obstruction (31), it rocks on the obstruction (31), lifting the vehicle (1) in the zone of said wheel (4) and thereby enabling the wheel (4) to pass onto the obstruction (31), characterised in that said elongate member (20) is connected to a portion of said spring (25) which remains in a substantially fixed position relative to said elongate member (20) throughout movement of said strut (18) between said ready position and said idle position (18').

14. A piston-and-cylinder device, including spring means (25) arranged in the cylinder (15) and acting between the piston (16) and the cylinder (15), an abutment (27) bearing one end of said spring means (25) and arranged to move longitudinally with one of the piston (16) and the cylinder (15) relative to the other, characterised in that said cylinder (15) and said piston (16) are turnable relative to each other about the axis of the cylinder (15) to adjust said abutment (27) along said one of the piston (16) and the cylinder (15), thereby to adjust said one end of said spring means (25) along said one of the piston (16) and the cylinder (15).

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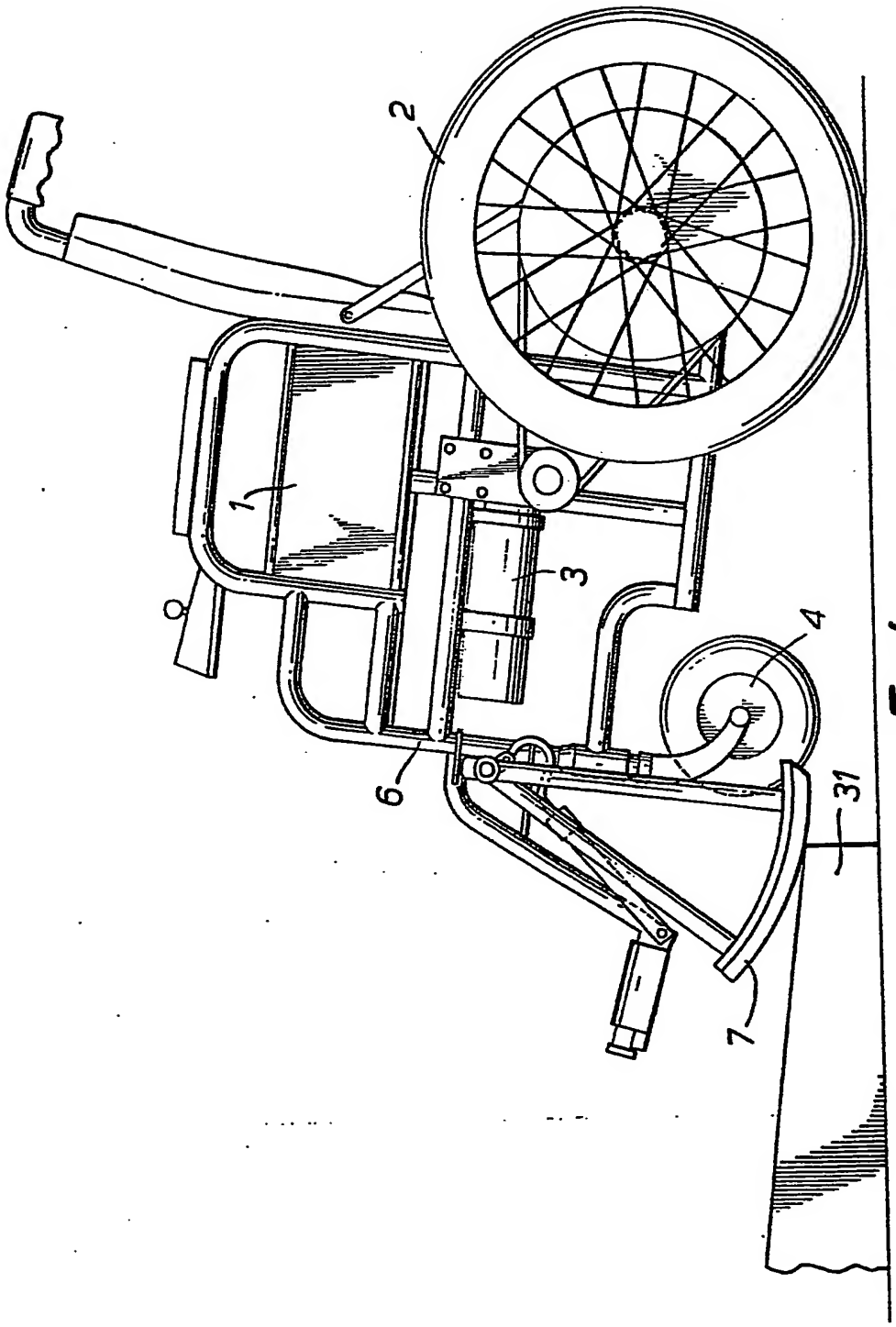

FIG. 1.

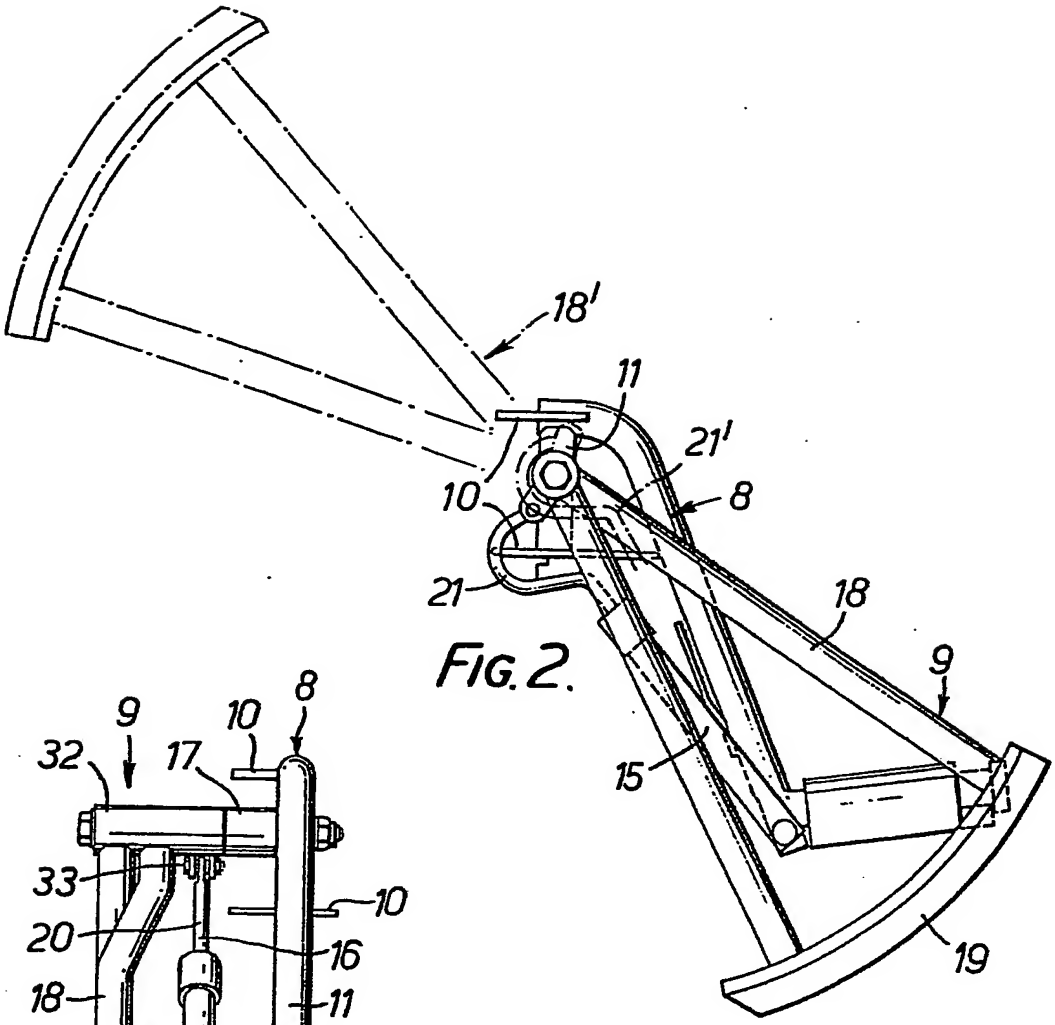

FIG. 2.

FIG. 3.

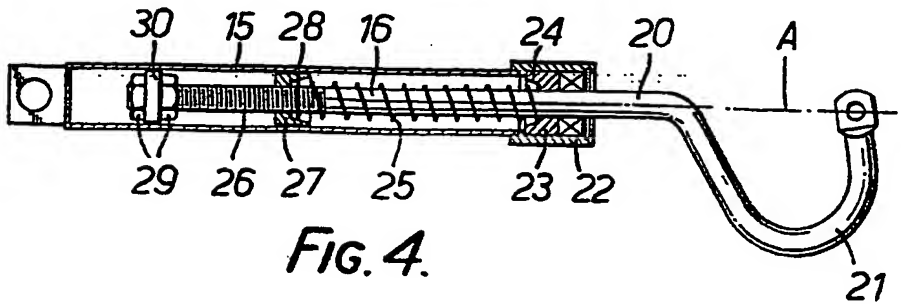

FIG. 4.

European Patent Office

EUROPEAN SEARCH REPORT

0127929
Application number

EP '84 30 1714

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	FR-A-2 373 428 (VESSA LTD.) * Page 1, lines 1-9, 16-40; page 2, lines 1-19; page 3, lines 3-40; page 4, lines 1-38; page 5, lines 21-40; page 6, lines 1-30; figures 1-7 * & GB - A - 1 569 166 (Cat. D)	1	A 61 G 5/00
A	---	7,10-13	
Y	US-A-3 722 638 (AUCO CORP.) * Column 2, lines 28-53; figure 1 *	1	
A	---	2,3	
D,Y	DE-A-2 922 963 (SCHNETZ) * Whole document *	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
D,A	---	5,6,14	A 61 G B 62 B F 16 F B 60 D
D,A	US-A-2 612 379 (REYNOLD) * Column 1, lines 1-30; column 3, lines 16-50; figures 1,4 *	1	
A	---		
	US-A-3 239 872 (J.V. KITRELL) * Whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-06-1984	BAERT F.G.

CATEGORY OF CITED DOCUMENTS

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